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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/066,835	02/04/2002	Tsann Lin	SJO920010058US1	4835

7590 01/29/2003
Brian C. Kunzler
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EXAMINER

BERNATZ, KEVIN M

ART UNIT	PAPER NUMBER
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1773

DATE MAILED: 01/29/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/066,835

Applicant(s)

LIN ET AL.

Examiner

Kevin M Bernatz

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-26 is/are pending in the application.
- 4a) Of the above claim(s) 13-26 is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-12 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☒ Claim(s) 1-26 are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on ____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. ____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). ____.
- 2) ☐ Notice of Draftperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 4. 6) ☐ Other: _____

DETAILED ACTION

Examiner's Comments

1. Applicants' claims have been interpreted in view of the entire disclosure, such that the "pinned" and "sensing" layers are required to be magnetic layers, the "spacer" layer is required to be a non-magnetic material and the "antiferromagnetic pinning" layer is required to be a layer formed from an antiferromagnetic material.
2. The examiner has interpreted the term "partially oxidized" in view of the specification and in view of the requirement that a term must be given its broadest reasonable interpretation. Since dielectric compounds such as Al_2O_3 will never be 100% oxidized and always possess a combination of metal and metal-oxygen compound, all dielectric oxides are deemed "partially oxidized" since there is presently no limit on the amount of oxygen in such a layer to constitute being "partially" oxidized. See pertinent prior art cited below (Okamoto and Lur et al.).
3. Amendments to the specification filed March 18, 2002 (Paper No. 3) have been entered in the above identified application.

Election/Restrictions

4. Restriction to one of the following inventions is required under 35 U.S.C. 121:
 - I. Claims 1 - 12, drawn to a spin valve sensor, classified in class 428, subclass 692.

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II. Claims 13 - 26, drawn to a method of making a spin valve sensor, classified in class 427, subclass 539.

5. The inventions are distinct, each from the other because of the following reasons:

Inventions I and II are related as process of making and product made. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make other and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case the product can be made by another and materially different process, such as by sputtering of an oxide layer, utilization of oxygen plasma or moving the system to an oxygen-containing atmosphere (see cited prior art below – Shimizu et al. and Sasaki et al.)

6. Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

7. During a telephone conversation with Mr. Brian Kunzler on January 16, 2003 a provisional election was made with traverse to prosecute the invention of Group I, claims 1 - 12. Affirmation of this election must be made by applicant in replying to this Office action. Claims 13 – 26 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

8. Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim

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remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

Double Patenting

9. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

10. Claims 1 – 6 and 10 - 12 are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1 - 17 of copending Application No. 09/919,280. This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

Although the conflicting claims are not identical, they are not patentably distinct from each other because 09/919,280 disclose a spin valve sensor comprising an antiferromagnetic pinning layer; a pinned layer disposed to one side of the antiferromagnetic pinning layer; a sensing layer; a spacer layer disposed between the pinned layer and the sensing layer (*claim 1*) and a gap layer disposed to one side of the

antiferromagnetic pinning layer, the gap layer comprising a plurality of oxidized metal films (*claims 12 - 15*).

Regarding claims 2 – 5 and 10 - 12, '928 claims substantially identical limitations (*claims 2 and 12 - 17*).

11. Claims 7 - 9 are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1 - 33 of copending Application No. 09/919,280 in view of Sasaki et al. (U.S. Patent Application Publication 2001/0013997 A1). This is a provisional obviousness-type double patenting rejection.

Application '280 is relied upon as described above.

Application '280 fails to claim a cumulative thickness meeting applicants' claimed limitations.

However, Sasaki et al. teach forming upper and lower gap layers comprising a plurality of stacked insulating alumina films (*Paragraphs 0034, 0039 and 0076*) identical to the claims structure of application '280, wherein the cumulative thickness is controlled to meet applicants' claimed limitations (*Paragraph 0076*) in order to improve the output by minimizing the shield gap length (*Paragraphs 0024 – 0027*).

It would therefore have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the claims of application '280 to claim a gap layer meeting applicants' claimed limitations as taught by Sasaki et al. in order to improve the output by minimizing the shield gap length.

Claim Objections

12. Claim 7 is objected to because of the following informalities: "oxidizedmetallic" should have a space.
13. Claim 10 is objected to because of the following informalities: claim 10 is missing a transitional phrase (i.e. insert "comprising" after "further" on line 1).
14. Claim 12 is objected to because of the following informalities: "one side of" should be inserted after "a second gap layer disposed to" on line 18 to correct a minor grammatical error, and also after "pinned layers formed disposed to" on line 6.

Claim Rejections - 35 USC § 112

15. The following is a quotation of the second paragraph of 35 U.S.C. 112:
- The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.
16. Claims 7, 8 and 12 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.
17. Regarding claims 7, 8 and 12, the phrase "between about" renders the claim(s) indefinite because the metes and bounds are ill defined. The phrase "between X and Y", meaning any value ranging from X to Y, excluding X and Y, is well defined if both X and Y are well defined. If either, or both, of X and Y are not well defined, then the phrase is indefinite because it is unclear which values are to be excluded from the

range. Deleting the word(s) "about" from the claim(s) is sufficient to overcome this rejection. *Ex parte Lee*, 31 USPQ2d 1105 (BdPatApp&Int. 1993).

As an example to better illustrate the Office's position, applicants should consider the following. The limitation "less than 10", clearly covers a range of "any value less than the value of 10, **excluding** 10". "Less than or equal to 10", clearly covers a range of "any value less than the value of 10, **including** 10". These limitations are not equivalent in that one provides more coverage than the other (i.e. a value of exactly 10 would only infringe on the latter limitation). Less than "about 10" is not clear because it isn't clear if the "about 10" implies values on the side already provided for by the "less than" part (i.e. an equivalent expression to "less than 9.993" instead of "less than 10") or if it is attempting to gain additional coverage by both **including** 10 and then some (i.e. an equivalent expression to "less than 10.0234" instead of "less than or equal to 10"). Since the specification does not provide guidance as to what the "about" covers, the claim is indefinite in terms of U.S.C. 112 2nd Paragraph since one of ordinary skill could not reasonably ascertain the full scope of the claim.

Claim Rejections - 35 USC § 103

18. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

19. Claims 1 – 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mao et al. (U.S. Patent Application Publication 2002/0024780 A1) in view of Sasaki et al. ('997).

Regarding claims 1 and 2, Mao et al. teach a spin valve sensor comprising an antiferromagnetic pinning layer (*Figure 4, element 310*), a pinned layer disposed to one side of the antiferromagnetic pinning layer (*elements 330, 340 and 350*), a sensing layer (*elements 360 and 370*), and a spacer layer (*element 240*) disposed between the pinned layer and the sensing layer.

Mao et al. fail to disclose the spin-valve sensor being disposed between gap layers, wherein the gap layer disposed to one side of the antiferromagnetic pinning layer comprises a plurality of oxidized metallic films.

However, Sasaki et al. teach forming upper and lower gap layers on either side of the MR element comprising a plurality of stacked insulating alumina films (*Paragraphs 0034, 0039 and 0076 - 0081*) in order to insulate the MR element and to improve the output by minimizing the shield gap length (*Paragraphs 0024 – 0027*).

It would therefore have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the invention of Mao et al. to include a gap layer meeting applicants' claimed limitations as taught by Sasaki et al. in order to insulate the MR element and to improve the output by minimizing the shield gap length.

Regarding claims 3 – 6, the limitation "*in-situ oxidized*" is a product-by-process limitation and is not further limiting in so far as the structure of the product is concerned. "[E]ven though product-by-process claims are limited by and defined by the process,

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determination of patentability is based on the product itself. ***Th patentability of a product does not depend on its method of production.*** If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process.”

[emphasis added] *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985). See MPEP § 2113. Once a product appearing substantially identical is found, the burden shifts to applicant to show an ***unobvious*** difference between the claimed product and the prior art product. *In re Marosi*, 710 F.2d 798, 802, 218 USPQ 289, 292 (Fed. Cir. 1983). In the instant case, both the prior art product and the claimed product possess a gap layer that is formed of a plurality of oxidized aluminum films (*Sasaki et al.: Paragraphs 0034, 0039 and 0047*) and there is no evidence of record that the method of production results in an unobvious difference between the claimed and prior art cap layers.

Regarding claims 7 - 9, Sasaki et al. teach forming the upper and lower gap layers with a cumulative thickness meeting applicants' claimed limitations (*Paragraph 0076*).

20. Claims 10 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mao et al. (U.S. Patent Application Publication 2002/0024780 A1) in view of Sasaki et al. ('997) and Mukoyama et al. (U.S. Patent Application Publication 2002/0054463 A1).

Mao et al. in view of Sasaki et al. are relied upon as disclosed above.

Regarding claims 10 and 11, Mao et al. further teach a spin-valve sensor comprising a conducting seed layer (*Figure 4, element 210*) disposed subjacent the antiferromagnetic pinning layer (*element 310*), the conducting seed layer comprising a NiCrFe film and a NiFe film (*Paragraph 0016*), the antiferromagnetic pinning layer formed of a Pt-Mn film (*Paragraph 0017*), a pinned layer disposed to one side of the antiferromagnetic pinning layer (*elements 330, 340 and 350*) formed of a CoFe film, an intervening Ru film, and a CoFe film (*Figure 4*), a spacer layer (*element 240*) disposed between the pinned layer and the sensing layer (*elements 360 and 370*) formed of a Cu film (*Paragraph 0019*), the sensing layer formed of a CoFe film (*element 360*) and a NiFe film (*element 370 and Paragraph 0021*), and the cap layer formed of a partially oxidized metallic film (*element 260 and Paragraph 0023 – “cap layer 260 is formed by allowing the top of free layer 250 to oxidize in the atmosphere”*).

Mao et al. fail to disclose an Al_2O_3 film as part of the seed layer, nor the cap layer being a partially oxidized metal film.

However, Sasaki et al. teach adding an additional Al_2O_3 film disposed to one side of the MR element (and therefore disposed to one side of the antiferromagnetic pinning layer which is part of the MR element) in order to prevent short circuiting between the MR element and the bottom shield layer (*Paragraph 0077*).

It would therefore have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the device of Mao et al. to include a lower Al_2O_3 seed layer meeting applicants' claimed limitations as taught by Sasaki et al. in order to prevent short circuiting between the MR element and the bottom shield layer.

Neither Mao et al. nor Sasaki et al. disclose using “an oxygen-doped, *in-situ* oxidized Cu film” for the spacer layer, though Mao et al. does disclose that the spacer layer “can be any of a wide variety of non-ferromagnetic materials”, including Cu (*Paragraph 0019*).

However, Mukoyama et al. teach that an oxidized Cu film (*Paragraphs 0017 and 0042*) can be used as a spacer film (*Figure 4, element 13*) between a sensing (*element 14*) and pinned magnetic layer (*element 12*) in order to improve the head output and symmetry of a reproduced signal waveform (*Paragraph 0015*).

It would therefore have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the device of Mao et al. in view of Sasaki et al. to use an oxidized Cu film as the spacer layer as taught by Mukoyama et al. in order to improve the head output and symmetry of a reproduced signal waveform.

The limitation “*in-situ* oxidized” is a product-by-process limitation and is not further limiting in so far as the structure of the product is concerned for the reasons cited above.

21. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Mao et al. in view of Sasaki et al. as applied above, and further in view of Jongill et al. (U.S. Patent Application Publication 2001/0014412 A1).

Mao et al. in view of Sasaki et al. are relied upon as described above.

Mao et al. further disclose a pinned layer disposed to one side of the antiferromagnetic material (*elements 220 and 230*), the magnetic orientation of the

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pinned layer substantially fixed by the antiferromagnetic layer (*Figure 4 and Paragraphs 0003, 0017 and 0018*), a sensing layer of ferromagnetic material (*Paragraph 0021*) adjacent to the pinned layers (*elements 230 and 250*), and the sensing layer configured to have an electrical resistance that changes in response to the changes in magnetic flux through the sensing layer (*Figure 4 and Paragraph 0003*). Furthermore, the additional limitations of the magnetic recording disk, actuator and detector are nominal apparatus limitations inherent in the disk drive system disclosed by Mao et al. (*Figure 2 and Paragraphs 0003 – 0005 and 0014*).

Mao et al. and Sasaki et al. fail to disclose a cap layer thickness meeting applicants' claimed limitations.

However, Jongill et al. teach a cap for a MR film comprising a dual oxide layer structure (*Figure 3, elements 7 and 8*), wherein the CuO layer is disclosed to meet applicants' claimed thickness limitations for improved MR properties and improved specular reflection (*Paragraphs 0014, 0015, 0019, 0020, 0024 – 0026, and 0122; and Figures 9 – 11*).

It would therefore have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the device of Mao et al. in view of Sasaki et al. to form a cap meeting applicants' claimed thickness limitations as taught by Jongill et al. in order to improve the MR properties and to improve the specular reflection.

The limitation "*in-situ* oxidized" is a product-by-process limitation and is not further limiting in so far as the structure of the product is concerned for the reasons cited above.

Conclusion

22. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Okamoto (U.S. Patent No. 6,329,087 B1) teaches aluminum-oxygen-nitrogen films wherein the amount of oxygen can vary from 0.05 – 0.8 atomic percent (*Abstract*). Lur et al. (U.S. Patent No. 5,451,804) teach that it is known in the art that the oxygen to aluminum ratio in alumina can vary and is common to refer to alumina as simply Al_xO_y (*col. 5, lines 21 – 28*). Shimizu et al. (U.S. Patent Application Publication 2002/0081457 A1) teach that oxidized (including surface oxidized) metal layers can be deposited by a variety of methods, including exposure to reactive O_2 gas, simply being left in an oxygen containing atmosphere, or by oxygen plasma (*Paragraph 0051*). Sasaki et al. ('997 A1) teach a method of forming multilayered insulating alumina films by chemical vapor deposition (*Paragraphs 0034, 0039 and 0047*). Yang et al. (U.S. Patent No. 6,452,767 B1) teach gap layers comprising multi-layered alumina/SiN films (*Figures 3 and 4c and col. 2, lines 5 – 25*). Hong et al. (U.S. Patent No. 6,198,608 B1) teach that it is known that spacer layers can be oxide materials versus metallic materials (*col. 5, lines 52 – 60: "a thin insulating or highly resistive layer 86 is interposed. The layer 86 may be composed of insulators such as SiO_2 , Ta_2O_5 or Al_2O_3 , or for example a high-resistive phase of Ta"*).

23. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kevin M Bernatz whose telephone number is (703) 308-1737. The examiner can normally be reached on M-F, 9:00 AM - 6:00 PM.


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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Paul Thibodeau can be reached on (703) 308-2367. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9310/872-9311 for regular communications and (703) 872-9311/872-9312 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.

KMB

KMB
January 25, 2003


Paul Thibodeau
Supervisory Patent Examiner
Technology Center 1700